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~~3~~ REFRIGERATED-STORAGE TESTS WITH LIMA BEANS IN THE POD ~~X~~

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SUMMARY

Tests with four lots of lima beans in the pod stored at 45°, 40°, 36°, and 32° F. for 7 and 14 days indicate that the pods were injured by low temperatures. Many pods developed rusty-brown to brown specks, spots, and larger discolored areas during refrigerated storage. Discoloration increased sharply during an additional day at 70°. Lima beans refrigerated for 14 days were injured more seriously than those refrigerated for 7 days. Injury during 7 or 14 days of refrigerated storage was so serious that it would be impractical, because of the number of unsalable pods, to store lima beans in the pod and expect to move them into wholesale or retail markets.

INTRODUCTION

Most commercially grown lima beans are harvested mechanically, shelled in the field, and sent directly to processing plants where they are either frozen or canned. Only a small part of the crop is presently shipped in the pod to wholesale markets. Some studies have been made on the refrigerated storage of shelled lima beans,² but apparently little research has been done on the refrigerated storage of lima beans in the pod. The few publications that have dealt with general storage of fruits and vegetables have stated that lima beans in the pod can be stored for 7 to 14 days at temperatures ranging from 32° to 45° F. Although these publications do not state that the beans can then be moved successfully through wholesale and retail markets, they imply this.

The absence of experimental data on storage requirements of lima beans in the pod prompted the brief study reported here. The primary purpose was to determine whether lima beans in the pod can be successfully refrigerated for 7 to 14 days and whether they will remain in a salable condition after removal from this refrigerated storage.

PROCEDURE

Fresh lima beans were obtained in the Washington, D.C., area during 1967. Two test lots of unknown varieties were obtained from a local Farmers' Market. The third test lot, similar to the Fordhook variety, was shipped from New Jersey and purchased on the Washington, D.C., wholesale market. The fourth test lot was the Improved Bush lima bean variety, freshly harvested from the field of a local market gardener.

The beans in the first three tests were comparable to the commercial product that might be placed in refrigerated storage. The beans in the fourth test were freshly harvested and carefully selected and, hence, should have shown most accurately any adverse effects of refrigerated storage.

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²Brooks, Charles, and McColloch, L. P. Stickiness and spotting of shelled green lima beans, U.S. Dept. Agr. Tech. Bul. 625, 24 pp, 1938.

Kaufman, J., and Ceponis, M. J. Extended shelf life for green lima beans, Prod. Market, 5: 32-33, 1962.

Beans in each test lot were sorted and those with mechanical damage or discolored specks and spots were discarded. The test beans were composited into eight lots and stored in open containers at 45°, 40°, 36°, and 32° F. for 7 and 14 days. The relative humidity at 45°, 40°, and 36° was maintained near 90 percent but at 32° was near 80 percent. An attempt was made to raise the humidity at 32° by adding a mist of water, but the practice was stopped after a few of the beans developed freezing injury. The beans that showed freezing injury were discarded and the results from tests of those beans are not included in the records.

RESULTS

The percentage of salable pods varied considerably among the lots of lima beans in refrigerated storage for 7 and 14 days. Variability appeared to be caused primarily by differences in maturity of the beans, number of days from harvest, and, perhaps, weather conditions in the field. For example, only 10 to 28 percent of the pods shipped from New Jersey were salable after 7 days of storage; whereas 90 to 100 percent of the freshly harvested pods were salable after 7 days of storage. A similar striking difference was found between these lots after 14 days of storage.

After an additional day at 70° F., more pods in lots stored for 7 days were salable than in lots stored for 14 days, indicating considerable deterioration during the second 7-day period.

In general, when removed from storage, fewer pods in lots stored at 45° F. and 40° were salable than in lots stored at 36° and 32° (table 1). These differences were less pronounced in lots stored for 7 days, however, after the pods were held for an additional day at 70°.

Although the percentage of salable pods after storage varied among lots, all four test lots responded similarly. In each test some of the pods showed speckling and darkening after refrigerated storage, and all lots showed serious spotting and discoloration after an additional day at 70° F.

Pods were considered salable if they were free of decay and of extensive discoloration, or if they showed only a slight amount of rusty-brown to brown speckling or spotting. "Fresh-green" pods were free of any discoloration, whereas "dull-green" pods were dull in color and many also showed very slight speckling.

The data (table 1) show that the pods were seriously affected by refrigerated storage. The extent of injury and decay is further stressed by the progressive deterioration after an additional day at 70° F.

Lima beans stored for 7 days at 45° to 32° F. had a relatively high percentage of unsalable pods because of discoloration, but had very little decay. After an additional day at 70°, discoloration increased sharply but decay was not serious and the pods were not sticky.

Lima beans stored for 14 days at 45° to 32° F. developed serious discoloration, and the percentage of botrytis rot was serious on beans stored at 45° and 40°. After an additional day at 70°, the pods deteriorated rapidly as indicated by increased discoloration on all pods, by increased botrytis rot on all pods previously stored at 45° and 40°, and by a sticky to slimy condition due to bacteria on most pods previously stored at 40°, 36°, and 32°.

Discoloration ranged from rusty-brown specks and spots to large discolored areas. In general, the discolored spots were fewer but larger on pods stored at 45° F. than on pods stored at lower temperatures. The discoloration was most pronounced, however, on pods stored at 40°.

These tests, although limited, show that lima beans in the pod cannot be stored for 7 to 14 days at 45°, 40°, 36°, or 32° F. and then be moved into wholesale and retail channels in an attractive condition.

Beans shelled from discolored pods appeared normal unless decay was present. The quality of the beans after refrigerated storage would depend on their quality when placed in storage and on the temperature and the number of days in storage. Less decay developed on stored bean pods and beans at 36° and 32° F. than at the higher temperatures.

TABLE 1.--Quality of 4 lots of lima beans in the pod stored for 7 and 14 days at 4 different temperatures

Time and Temperature of storage (°F.)	Total pods	Condition when removed from storage				Condition after an additional day at 70° F.					
		Salable pods			Unsalable pods		Salable pods			Unsalable pods	
		Total	Fresh green	Dull green	Total ¹	Decayed ²	Total	Fresh green	Dull green	Total ¹	Decayed ²
	<u>Number</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
7 days:											
45-----	734	48	18	30	52	0.3	27	3	24	73	3
40-----	778	43	15	28	57	0.6	18	3	15	82	8
36-----	698	60	36	24	40	0	19	2	17	81	0
32-----	744	58	32	26	42	0	20	2	18	80	0
14 days:											
45-----	706	15	1	14	85	19	3	0	3	97	31
40-----	677	15	0	15	85	28	0	0	0	100	40
36-----	696	46	22	24	54	1	1	0	1	99	6
32-----	684	47	25	22	53	0	15	0	15	85	5

¹Pods not showing decay were considered unsalable because of specks or other discoloration.

² Botrytis rot (*Botrytis cinerea* Fr.)

³ *Botrytis* rot (*Botrytis cinerea* Fr.) Pods not showing decay were sticky to slimy.

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